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DATE: Friday, July 15, 2005

Hide?	Set Name	Query	Hit Count
		DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ	
☐	L7	L6 and ((position or location) near5 identifier)	15
☐	L6	20000215	363
☐	L5	mobile IP	2140
☐	L4	20000215	3
☐	L3	L2 and query	24
☐	L2	L1 and ((position or location) near5 identifier)	54
☐	L1	mobile near5 (device or computer) near5 management	1354

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DATE: Friday, July 15, 2005

Hide?	Set Name	Query	Hit Count
		DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ	
☐	L4	L3 and (register or registration)	12
☐	L3	20000215	14
☐	L2	L1 and (mobile near5 (device or computer or IP))	79
☐	L1	((movement or motion) near5 (detection or detect)) and ((location or position) near8 management)	370

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L7: Entry 2 of 15 File: USPT Jun 15, 2004

DOCUMENT-IDENTIFIER: US 6751459 B1
TITLE: Nomadic computing with personal mobility domain name system

Abstract Text (1):
A method and apparatus for updating information in a personal mobility database server with information concerning a user's nomadicity. When the user travels from one place to another, the user registers with PMDNS server at an IP port for computing communications. PMDNS takes user's terminal personalization, together with usage profile, session characteristics into account to map a party's identifier to a terminal's identifier. The IP address of the user's current location is used in concert with the terminal's identifier, which is itself an IP address, to route incoming computing communications connection requests to the current location of the user. This information will be returned by the PMDNS directory server to the access network for the setup of the communications.

Application Filing Date (1):
19990420

Brief Summary Text (9):
Nomadic computing is a newly emerging technology. Among the solutions being proposed, mobile IP is the most prominent. Mobile IP is an extension of IP that allows mobile nodes to roam transparently from place to place within the Internet. Mobile IP affects the routing of datagrams within the Internet by effectively allowing the home agent to create a tunnel, using encapsulation, between the mobile node's home IP address associated with its home network and whatever care-of address identifies its current point of attachment.

Brief Summary Text (10):
The ability provided by mobile IP to deliver packets to a mobile computer or some other mobile station does not completely solve the problem of nomadic computing. Some of the key requirements imposed by nomadic computing include: enabling interoperation among many kinds of infrastructures; dealing with the unpredictability of user behavior, network capability and computing platforms; and delivering maximum independence between the network and the application. The emerging trend toward nomadicity is characterized by multimedia, networking and portability.

Brief Summary Text (15):
To accomplish such operations, a personal mobility directory server is updated with information concerning a user's nomadicity. When the user travels from one place to another, the user registers with a PMDNS server at an IP port for computing communications. The PMDNS employs the user's terminal personalization together with a usage profile and session characteristics to map a party's identifier to a terminal's identifier. The IP address of the user's current location can be used in concert with the terminal's identifier, which is in itself an IP address, to route incoming computing communications connection requests to the current location of the user. This information is returned by the PMDNS directory server to the access network for the setup of the communications.

Detailed Description Text (41):
FIG. 4 is a table representing a plurality of user records stored in a PMDNS database server and a portion of the information stored in such user records according to the present invention. These user records include user records 412, 414, 416 and 418. Each user record is associated with a particular user of the PMDNS. A typical user of the PMDNS system uses several different types of terminals, each of which has its own address, etc., and each of which is accessible via a particular network. For example, a wireless phone has a 10-digit mobile identification number (MIN) used to access the wireless phone via the PSTN or wireless network, and a Mobile IP terminal has a 32-bit IP address used in the IP network. According to the present invention, each of user records 412-416 includes a plurality of TIDs, and a corresponding PID serves as an entry point for the user record and the associated terminals. Each of user records 412-418 also includes at least one PID 401, a password 402, a user profile 403, a historical usage table 404, a network usage profile 405, and a plurality of terminal records each of which includes a type 406, a terminal address 408 for each data type, a care-of-address (COA) 409 associated with each IP address, and a time of last use 411.

Detailed Description Text (52):
To locate the PMDNS server application at step 506, the PMDNS user application must know the address of its PMDNS server application. For the purpose of routing efficiency, a roaming mobile IP terminal or a roaming cellular phone user should be able to access a local PMDNS server application. For this purpose, the PMDNS user application should be configured with two important parameters: the address of at least one of the PMDNS server applications, PMDNS.ADDRESS; and the time to live (TTL) of the address PMDNS.TTL.

Detailed Description Text (109):
When a user travels from one place to another, the user may notify the PMDNS server of unexpected deviations in the user selected preferences by de-registering from the current IP address. The PMDNS server is then forced to analyze usage records for the most appropriate TID for the user's PID. After the user physically connects to a new network port, the user registers with the PMDNS server at an IP port for computing communications, and the PMDNS binds the present IP address to the IP address of the user terminal. The PMDNS server application uses the user's terminal personalization, together with the usage profile and session characteristics, to map a party's identifier to a terminal's identifier. This information is returned by the PMDNS directory server to the access network for setup of the communications. In this way, the IP address of the user's current location is used in concert with the terminal's identifier to route incoming computing communications connection requests to the current location of the user.

Detailed Description Text (114):
FIG. 8 illustrates the nomadic computing process initiated by a user registering a user terminal at a new IP address. The process of FIG. 8 begins when the user physically connects the terminal to a new connection having a different IP address from that of the TID of the user application (step 802). The user then launches the PMDNS user application for the PID on the user terminal (step 804). Rather than attempting to locate a local PMDNS server application, as is the case when using a mobile IP address, here the PMDNS user application locates its own PMDNS server application for the IP address for which it was originally configured (step 806). The registration request is then made to the PMDNS server application (step 804).

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L7: Entry 3 of 15 File: USPT May 11, 2004

DOCUMENT-IDENTIFIER: US 6735202 B1
TITLE: Mobility management techniques for use in an internet protocol-based multimedia mobile network

Application Filing Date (1):
20000110

Brief Summary Text (4):
Several important mobility management issues need to be addressed in designing a communications system wherein the system is characterized by a dynamic network topology (e.g., mobile system access points or network nodes) and a relatively large number of mobile end users. Particularly, critical among them are issues such as: keeping track of mobile end users and access point locations in the system (i.e., location management); reaching and initiating communications with a mobile end user (i.e., mobile access); and continuity of service when a mobile end user moves between coverage areas associated with different system access points (i.e., handoff management). Existing networks have attempted to provide solutions to these problems in their specific domains. For example, limited solutions have been provided by Cellular Digital Packet Data (CDPD) networks, Cellular/Personal Communications Services (Cellular/PCS) systems, and Mobile Internet Protocol (mobile IP) networks. However, there are several known limitations to these conventional approaches owing to the fact that they were designed for different operating conditions.

Detailed Description Text (18):
As mentioned, connectionless switching is preferably employed within the inter-node network 108. Since many of the applications in the end-systems may be based on TCP/IP or User Datagram Protocol/Internet Protocol (UDP/IP) it would appear proper, at first glance, to employ connectionless switching based on IP within the inter-node network. However, in a highly mobile environment such as system 100, conventional IP-based routing, even with the enhancements added by Mobile IP, introduce many inefficiencies (e.g., triangular routing and frequent registration) in the overall operation.

Other Reference Publication (7):
Perkins, C.E., et al., "Route Optimization in Mobile IP," draft-ieft-mobileip-optim-07.txt, Nov. 20th, 1997.

Other Reference Publication (8):
Perkins, C.E., "Mobile IP," IEEE Communications Magazine, pp. 84-89, May 1997.

Other Reference Publication (9):
Solomn, J.D., "Mobile IP: the Internet Unplugged," Prentice Hall, 1998.

CLAIMS:

1. A method of managing mobility associated with one or more mobile user stations and one or more mobile network nodes in an Internet Protocol (IP) based communications system, comprising the steps of: generating a location update

message including a temporary location IP address representing a new location associated with a mobile user station that has moved or plans to move from a coverage area of one network node to a coverage area of another network node, wherein the temporary location IP address is a combination of an identifier of the mobile user station and an identifier of a network node in the communications system with which the mobile user station is currently associated, and wherein the location update message includes an IP header field, a UDP header field and a message field; and sending the location update message to at least one of a mobile user station and a network node in the communications system.

14. A method of managing mobility associated with one or more mobile user stations and one or more mobile network nodes in an Internet Protocol (IP) based communications system, comprising the steps of: generating a location query message to determine a temporary location IP address representing a location associated with a mobile user station in the communications system, wherein the temporary location IP address is a combination of an identifier of the mobile user station and an identifier of a network node in the communications system with which the mobile user station is currently associated, and wherein the location query message includes an IP header field, a UDP header field and a message field; and sending the location query message to at least one network node in the communications system.

29. A method of managing mobility associated with one or more mobile user stations and one or more mobile network nodes in an Internet Protocol (IP) based communications system, comprising the steps of: generating a registration message to request at least one of de-registration of a mobile user station with a current network node and registration of the mobile user station with a new network node, wherein the registration message is a request to: (i) allow the mobile user station to use an identifier of the network node as part of a temporary location IP address; and (ii) route packets destined to and from the mobile user station via the network node, and wherein the registration message includes an IP header field, a UDP header field and a message field; and sending the registration message to the appropriate network nodes in the communications system.

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L7: Entry 5 of 15 File: USPT Nov 25, 2003

DOCUMENT-IDENTIFIER: US 6654607 B1
TITLE: Method and apparatus for enabling and monitoring mobile communication across platforms

Application Filing Date (1):
20000214

Brief Summary Text (6):
Varieties of mobile communication protocols are available including cellular, mobile IP, DHCP/DNS and SIP. While the protocols vary in how they function, each implementation of the protocol needs to support standard functions including location registration, location resolution, authentication, authorization, and accounting. Location registration relates to a mobile terminal announcing and receiving confirmation of its location within a network or platform. Location resolution relates to the determination of where a mobile terminal is in a network. Authentication relates to a function of a network determining whether a certain mobile user is a confirmed user of a network through interactions with at least one database. Authorization relates to a function of a network determining whether a certain mobile user is allowed to use a service of the network through interactions with at least one database. Accounting relates to a function of a network monitoring and assessing fees to a certain mobile terminal. Authentication, authorization, and accounting are referred to generally as "AAA" functions. In general, location registration occurs at the power-on phase of a terminal and during the handoff of a terminal between sites in a network. At the same time, authentication may be performed. Location resolution generally occurs when a first terminal attempts to set up a communication channel with a second terminal. Again, authorization may be performed at this time for both the first terminal and the second terminal. Accounting is generally performed while a terminal is actively communicating with another terminal. For simplicity, the terminal initiating a communication is herein referred to as the "caller" and the terminal attempting to be contacted is the "callee."

Brief Summary Text (7):
For purposes herein, a platform may be defined as a portion of a network where identical signaling protocols handle the operations of connection set-up, connection tear-down, hand-off, location registration, location resolution, and accounting (or charging). Moreover, a platform may be a portion of a network that is provided by one operator, even if the signaling protocol for Operator A's network is the same as the protocol as Operator B's network. For example, one operator (for example, Bell Atlantic Mobile) may have a number of platforms within the network controlled by the operator. The first platform would use CDMA, the second would use Analog AMPS, and the third would use Mobile IP, etc. In the latter case, the border between platforms using identical protocols but operated by different operators is controlled by a mobility database. Each operator manages its mobility database independently.

Brief Summary Text (10):
Mobile IP network 102 includes mobility database 106 called HA (Home Agent), which stores IP address as TID and LID, a set of platform-specific information as

password, permission list and accounting list. The current standard of Mobile IP (RFC2002) includes a special function called FA (Foreign Agent), which handles Mobile IP-specific functionalities. However, these Mobile IP-specific functionalities are well-known and are beyond the scope of the invention. DHCP/DNS network 103 includes mobility database 107 called Domain Name System, which stores Host Name and Domain Name as TID, IP address as LID, and a set of platform-specific information as password, permission list and accounting list. Here, DHCP (Dynamic Host Configuration Protocol) may be used for assigning an IP address at an access point where a Mobile Terminal currently visits. Also, the dynamic DNS currently discussed at IETF may be used for advertising the assigned IP address to the whole network. SIP network 104 includes mobility database 108 called SIP Proxy, which stores SIP URL as TID and LID, and a set of platform-specific information as password, permission list and accounting list.

Brief Summary Text (13):
Another approach has been suggested by TIA (the Telecommunications Industry Association). TIA supports the TR45.6 architecture for implementing IP service. This architecture has two tiers including an access network and a core network. Referring to FIG. 1D, the core network is represented by the mobile IP-capable IP network 120. The access networks are represented by the cellular networks 123 and 124. IP network 120 includes foreign agent FA 121 and home agent HA 122 that functions as the mobility database (monitor and coordinate location registration and resolution) for this network. Each of networks 123 and 124 includes visiting location registers VLR 126 and 129 and home location registers HLR 127 and 130. The combination of the HLRs and the VLRs functions as the mobility database for these networks. It is noted that the IP network 120 is not necessarily synonymous with the Internet. The Internet is open to all traffic. IP network 120 may be part of the Internet or may be separate from the Internet. Similarly, the IP network 120 may be limited to IP communications.

Detailed Description Text (6):
An example of an entry in alias database 305 for cellular platform 101 is as follows: (212) 556-1234 is an alias for "doug.domainname.com" on the DHCP/DNS platform 103. Another example includes (800) 345-6789 as an alias for an 800 service (toll free) that is provided by "123.456.78.9" on the mobile IP network 102. Accordingly, a mobile terminal on an E.164 network may place calls to mobile terminals on other networks.

Detailed Description Text (21):
To enable efficient handoffs, each platform gateway 905, 906 and 907 may include the TID and alias identifiers of MT-A and MT-B for the various platforms. The terminals MT-A and MT-B may have more than one native protocol and more than one home network or platform. For example, MT-A may be a dual-mode/multi-band telephone that functions in both a cellular (1G/2G) environment as well as in a mobile IP environment.

Detailed Description Text (22):
As an example for FIGS. 11 and 12, platform A 901 is considered to be a mobile IP platform, and platforms B 902, C 903, and D 904 are considered to be cellular platforms supporting, for instance, E.164. MT-A is provided with platform B 902 as being its home network. MT-B is described as having platform A 901 as its home network. The TIDs are described in relation to each of MT-A's and MT-B's home platforms.

Detailed Description Text (24):
FIG. 12 shows the system for managing handoff between remote platforms. When MTB moves from platform C to platform D, it determines it location (through techniques well known in the art) and transmits its new location to the mobility database of the platform C. This may be referred to as a backward handoff. The handoff procedure may start prior to having a new communication pathway established at the

new location. However, MT-B's native mobility database 1012 located on platform A 901. MMGW 1004 on platform C traps the location update message. By examining the message, MMGW 1004 determines that the native mobility database for MT-B is on platform A 901. MMGW 1004 next forwards the new location message to mobility database 1012. Based on this exchange, the handoff protocols on platforms A 901, C 903, and D 904 change to accommodate the change in location of MT-B. An example in the change in protocol includes MMGWs 1003, 1004 and 1005 modifying the header information they place on the messages (or message packets) as the packets are handled by the MMGWs. In particular, the address to send messages to in platform B will be rewritten to a new IP address in platform A (the mobile IP network) and a new path between the platform gateway and a new location will be created in platform B (the cellular network). Further, the alias database 1007 on platform A may contain routing information showing which platform gateway is preferable to reach a certain location in order to set up a cross-platform communication channel.

Detailed Description Text (27):
FIG. 15 shows a process performed by the MMGW for location resolution. As represented by step 1501, the MMGW intercepts a message from MT-A to MT-B. The MMGW next checks to determine whether an identifier in the message is registered in the alias database (step 1502). If the identifier has been registered, the MMGW inquires the location of the MT-B from the second platform mobility database (the native platform of MT-B) (step 1503). If the identifier has not been registered in the alias database, the MMGW inquires the location of the MT-B from the first platform database (step 1504).

CLAIMS:

1. A system for providing a network communications pathway between communication platforms comprising: a first communication platform supporting a first protocol, said first communication platform associated with a first mobility database, said first mobility database storing plural pairs of a first terminal identifier and a first location identifier, each pair corresponding to a respective first mobile terminal on said first communication platform; a second communication platform supporting a second protocol, said second communication platform associated with a second mobility database, said second mobility database storing plural pairs of a second terminal identifier and a second location identifier, each pair corresponding to a respective second mobile terminal on said second communication platform; a first alias database storing a first alias of the first terminal identifier of said first mobile terminal in a form compatible with said second protocol; a second alias database storing a second alias of the second terminal identifier of said second mobile terminal in a form compatible with said first protocol; and a mobility manager connected to both said first communication platform and said second communication platform, said mobility manager determining whether a destination of a first message is registered in said second alias database and, if the destination of the first message is registered in said second alias database, forwarding the first message to said second terminal corresponded with said second communication platform from said first terminal corresponded with said first communication platform, and determining whether a destination of a second message is registered in said first alias database and, if the destination of the second message is registered in said first alias database, forwarding the second message to said first terminal corresponded with said first communication platform from said second terminal corresponded with said second communication platform.

2. The system according to claim 1, further comprising: a third communication platform supporting a third protocol, said third communication platform associated with a third mobility database, said third mobility database storing plural pairs of a third terminal identifier and a third location identifier, each pair corresponding to a respective third mobile terminal on said third communication

platform, wherein a third alias of said third terminal identifier is stored in said first alias database in a form compatible with said second protocol and a fourth alias of said third terminal identifier is stored in said second alias database in a form compatible with said first protocol.

9. A method for communicating across communication platforms, comprising: storing plural pairs of a first terminal identifier and a first location identifier, each pair corresponding to a respective first mobile terminal on a first communication platform in a first mobility database; storing plural pairs of a second terminal identifier and a second location identifier, each pair corresponding to a respective second mobile terminal on a second communication platform in a second mobility database; storing a first alias of said first terminal identifier in a first alias database; storing a second alias of said second terminal identifier in a second alias database; receiving a first message from the second mobile terminal on the second communication platform, said first message addressed with said first alias, and receiving a second message from said first mobile terminal on said first communication platform, said second message addressed with said second alias; retrieving said first alias and said first terminal identifier from said first alias database and retrieving said second alias and said second terminal identifier from said second alias database; and associating said first terminal identifier with said first message and forwarding said first message to said first communication platform, and associating said second terminal identifier with said second message and forwarding said second message to said second communication platform.

16. A system for providing a network communications pathway between communication platforms comprising: a first communication platform supporting a first protocol, said first communication platform associated with a first mobility database, said first mobility database storing plural pairs of a first terminal identifier and a first location identifier, each pair corresponding to a respective first mobile terminal on said first communication platform; a second communication platform supporting a second protocol, said second communication platform associated with a second mobility database, said second mobility database storing plural pairs of a second terminal identifier and a second location identifier, each pair corresponding to a respective second mobile terminal on said second communication platform; an alias database storing an alias of the first terminal identifier of said first mobile terminal in a form compatible with said second protocol; and a mobility manager connected to both said first communication platform and said second communication platform, said mobility manager checking whether a destination of a first message is registered in said alias database and, if the destination of the first message is registered in said alias database, forwarding the first message to said first mobile terminal from said second mobile terminal.

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L7: Entry 8 of 15 File: USPT Jan 21, 2003

DOCUMENT-IDENTIFIER: US 6510153 B1
TITLE: Mobile IP communication scheme using dynamic address allocation protocol

Abstract Text (1):
A mobile IP communication scheme in which the mobile computer can be operated using the mobile communication protocol such as Mobile IP even in the case where the home network is operated by the dynamic address allocation protocol such as DHCP is disclosed. The current location registration message to be transmitted by the mobile computer from the visited site to the mobile computer management device contains an information indicating that the dynamic address allocation has been received at the home network and an information capable of identifying the mobile computer, and the mobile computer management device carries out exchanges with the dynamic address management server on behalf of the mobile computer, so that the mobile computer which has received the dynamic address allocation at the home network can be operated at the visited site by using the mobile communication protocol.

Application Filing Date (1):
19990219

Brief Summary Text (9):
For example, in FIG. 1, this role is played by a home agent (HA) 5 in a case where the mobile computer 2 that originally belongs to the home network 1a moves to another network 1b and carries out the communication with another computer (correspondent host: CH) 3 within the other network 1c. This is a scheme called Mobile IP which is currently in a process of being standardized by the mobile-IP working group of the IETF which is the standardizing organization for the Internet (see, IETF RFC 2002, IP mobility support (C. Perkins)).

Brief Summary Text (10):
Now, in the Mobile IP scheme, the mobile transparency of the mobile computer on the IP networks is supported by continually using a fixed address assigned at a network (home network) to which the mobile computer originally belongs even at visited sites. This address will be referred to as a home address. When the mobile computer moves to a new visited site, the mobile computer sends a current location registration message as shown in FIG. 2 to the home agent, according to the specification of RFC 2002. In FIG. 2, "Home Address" is the home address of the mobile computer, "Care-of Address" is a temporal address for receiving packets transferred from the home agent at the visited site network, which is to be used as a destination address to be attached to an outer header of (encapsulated) data to be transferred from the home agent.

Brief Summary Text (11):
Namely, in order to carry out communications according to the Mobile IP of RFC 2002, two addresses of (1) a fixed home address of the home network, and (2) a Care-of address allocated at the visited site network, are necessary.

Brief Summary Text (14):
If the home site of the mobile computer which moves while using the Mobile IP is

operated by this DHCP, there is no guarantee for being capable of acquiring a specific IP address again when the mobile computer is re-connected at the visited site or the mobile computer moves to another subnet. Also, there can be cases where, after the mobile computer moves, another host uses an IP address that has been used by the mobile computer up until then, so that it is difficult to use the address allocated by the DHCP as a home address of the Mobile IP according to the conventional specification of RFC 2002 alone.

Brief Summary Text (15):
Thus in the conventional Mobile IP scheme, if the home network of the mobile computer is operated by the dynamic address allocation such as DHCP, there is a difficulty when the mobile computer tries to re-connect after moving to the visited site, in that there is no guarantee for continually using an address that has been allocated at the home site up until then. In particular, in the case of carrying out home address dependent communication processing at the visited site, such communications become impossible when the home address is changed.

Brief Summary Text (17):
It is therefore an object of the present invention to provide a mobile IP communication scheme in which the mobile computer can be operated using the mobile communication protocol such as Mobile IP even in the case where the home network is operated by the dynamic address allocation protocol such as DHCP.

Detailed Description Text (2):
Referring now to FIG. 1 to FIG. 17, one embodiment of a mobile IP communication scheme according to the present invention will be described in detail.

Detailed Description Text (3):
FIG. 1 shows an exemplary basic configuration of a communication system according to the first embodiment. This communication system of FIG. 1 is assumed to be supporting communications of a mobile computer according to the Mobile IP. Note that the Mobile IP protocol specified by RFC 2002 has two modes including a mode that assumes an existence of a router called foreign agent (FA) for carrying out a packet delivery with respect to the mobile computer at a visited site network and a Co-located Care-of address mode in which no foreign agent is provided (the mobile computer itself plays the role of a foreign agent), and the following description will be given for an exemplary case of adopting the latter mode.

Detailed Description Text (6):
The home network 1a is provided with a home agent (HA) 5 for managing an information on a current location at the visited site of the mobile computer in order to support the Mobile IP. Here, the number of mobile computers to be managed by one home agent is arbitrary. As described above, a transferred IP packet destined to the mobile computer 2 on move is captured by the home agent 5 at the home network, where the routing control for data with respect to the mobile computer 2 can be realized by encapsulating an IP packet destined to an original address (an address in the home network 1a) of the mobile computer 2 within a packet in the Mobile IP format which is destined to the current location address.

Detailed Description Text (9):
"FLAG" indicates an operation mode (such as an encapsulation method) of the Mobile IP.

Detailed Description Text (19):
Now, the exemplary case of applying the mobile IP communication scheme of the present invention to a communication system in which the home network to which the mobile computer 2 belongs is managed by the dynamic IP address allocation will be described. Here, the mobile computer of the present invention receives the dynamic IP address allocation according to the DHCP, but the other computers or mobile computers may receive the IP address allocation according to the other schemes.

Also, the following description is directed to a case of allocating IP addresses according to the DHCP as specified by RFC 1541 and 2131, but the present invention is equally applicable to any dynamic address allocation scheme other than the DHCP.

Detailed Description Text (23):
Here, the basic processing regarding the mobile IP communications by the mobile computer 2 and the home agent according to this embodiment will be described.

Detailed Description Text (24):
The mobile computer 2 carries out a processing for requesting a reservation of a DHCP address (address A in this example) which is a dynamic address, to a DHCP server or a home agent 5 prior to moving (there is also an implementation which does not carry out this processing). Note that, as will be described in detail below, some mobile computer 2 requests a reservation of some dynamic address in this embodiment, and it is assumed that there can be cases where this dynamic address is allocated to another computer before this mobile computer 2 is connected to a visited site network and the registration processing of the Mobile IP is successfully completed.

Detailed Description Text (25):
When the mobile computer 2 moves to the other section network (referred to as 1b in the following example), the mobile computer 2 carries out the moving detection processing and the Care-of Address acquisition processing (either one of which is executed first depending on the implementation) as well as the Mobile IP registration processing or the Mobile IP re-registration processing. In the Mobile IP registration processing, a processing for dealing with a case where the DHCP address allocated to this mobile computer 2 before the moving is now allocated to another computer during the moving is also carried out. Note that the exemplary configuration of the mobile computer 2 will be described later on in conjunction with the detailed description of the operation (see FIG. 6, FIG. 7, FIG. 14 and FIG. 17).

Detailed Description Text (26):
FIG. 5 shows an exemplary configuration of a main portion of the home agent 5. The home agent 5 has a Mobile IP processing unit 100 and a proxy DHCP processing unit 101. The Mobile, IP processing unit 100 includes a registration response returning unit 105 and a registration information receiving unit 106. A management table 102, a judgement processing unit 103 and an address change processing unit 104 can be provided (or not provided) according to the need either separately or in arbitrary combination. Details of these constituent elements of the home agent 5 will be described later on.

Detailed Description Text (29):
When the Mobile IP registration message is received from the mobile computer 2 having a dynamic address, in addition to the usual Mobile IP registration processing for a mobile computer having a fixed address, a processing for re-allocating the DHCP address (home address) which is a dynamic address currently held by that mobile computer 2 or a processing for dealing with a case where this DHCP address is already allocated to another computer is carried out.

Detailed Description Text (30):
When the Mobile IP re-registration message is received from the mobile computer 2, in addition to the usual Mobile IP re-registration processing for a mobile computer having a fixed address, a processing to continue reserving the allocation of the DHCP address (home address) which is a dynamic address currently held by that mobile computer 2 is carried out, at least while the re-registration message is received without exceeding the valid period of the Mobile IP (there is also an implementation in which this processing to continue reserving is finished at a time of receiving an initial registration message).

Detailed Description Text (33):
Since the mobile computer 2 has received the dynamic address allocation, there is a possibility for the DHCP address used by the mobile computer 2 before the moving to get allocated to another computer while the mobile computer 2 is moving over networks. Consequently, in order to operate the mobile computer properly in the case where the mobile computer moves while carrying out connection-oriented communications such as TCP or the case of assuming the use of a service such as interactive software that presupposes the use of a fixed address and takes a procedure involving a reply to a call from a third person, it is preferable to have a higher probability for being able to maintain the dynamic address allocated to the mobile computer for carrying out the Mobile IP communications unchanged, by accounting for the conformity with the utility of the dynamic address allocation mechanism.

Detailed Description Text (34):
For this reason, in this embodiment, in the case where the mobile computer 2 moves to the other section network by leaving the home network 1a (especially when the mobile computer 2 tries to carry out communications based on the Mobile IP at the other section network at the visited site), prior to that moving, a processing for preventing (or increasing a probability of being able to prevent) the allocation of the DHCP address leased from the DHCP server 7 to the mobile computer 2, to another computer during the moving, is carried out.

Detailed Description Text (46):
The home agent 5 transmits the DHCPREQUEST message with the lease time set to be a time x at a prescribed interval of a time y which is approximately the same as or longer than x, for the DHCP address allocated to that mobile computer 2. For example, the DHCPREQUEST message with the lease time set to be 30 minutes is transmitted at one hour interval (in which case the lease time is made to expire intentionally). This processing is carried out until the location registration message for the Mobile IP communications is received from that mobile computer 2, for example, as long as the address can be reserved successfully. In this way, it is possible to maintain the DHCP address of the mobile computer 2 at a higher probability than conventionally possible albeit it is not 100%, by accounting for the conformity with the utility regarding the reusability of addresses according to the DHCP.

Detailed Description Text (48):
The home agent 5 continually transmits the DHCPREQUEST message to the DHCP server such that the lease time will not expire, for the DHCP address allocated to that mobile computer 2. For example, the DHCPREQUEST message with the lease time set to be a time x is transmitted at interval of a time y which is shorter than x. This processing is carried out until the location registration message for the Mobile IP communications is received from that mobile computer 2, for example. In this way, the allocation of the DHCP address of the mobile computer 2 can be maintained without failure.

Detailed Description Text (76):
Note that in the case where it is detected that the mobile computer is located in the home network by the moving detection or in the case where the mobile computer is located outside the home network but there is no need for the Mobile IP communications, the usual IP communications will be carried out using the newly acquired address. Also, in the case where it is detected that the mobile computer is located in the home network by the moving detection, it is also possible to transmit a DHCPREQUEST message for the DHCP address allocated to the own device at that moment, and receive the new DHCP address allocation if a DHCPACK message is returned.

Detailed Description Text (77):

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L7: Entry 10 of 15 File: USPT Aug 27, 2002

DOCUMENT-IDENTIFIER: US 6442616 B1
TITLE: Method and apparatus for communication control of mobil computers in communication network systems using private IP addresses

Application Filing Date (1):
19970116

Brief Summary Text (16):
According to one aspect of the present invention there is provided a method for controlling communications in a communication network system formed by a plurality of computers for communicating data with each other through a plurality of interconnected networks, said plurality of computers including at least one mobile computer for communicating data while changing a location in the communication network system, the method comprising the steps of: (a) when the mobile computer is located within a home network of the mobile computer, carrying out a communication with the mobile computer by transferring communication data using a first location identifier specific to the mobile computer which is uniquely defined within own organization networks of the mobile computer; (b) when the mobile computer is located within an external own organization network, carrying out a communication with the mobile computer by routing communication data to the external own organization network using a third location identifier indicating a current visited location of the mobile computer in the communication network system which is uniquely defined over all the networks, and addressing the mobile computer within the external own organization network using the first location identifier; and (c) when the mobile computer is located within an external other organization network, carrying out a communication with the mobile computer by routing communication data to the external other organization network using the third location identifier, and addressing the mobile computer within the external other organization network using a second location identifier assigned to the mobile computer at a time of moving outside the own organization networks which is uniquely defined over all the networks.

Brief Summary Text (17):
According to another aspect of the present invention there is provided a relay device for relaying communication data in a communication network system formed by a plurality of computers for communicating data with each other through a plurality of interconnected networks, said plurality of computers including at least one mobile computer for communicating data while changing a location in the communication network system, the relay device being provided in a home network of the mobile computer and comprising: management means for managing the address information for the mobile computer within own organization networks of the mobile computer, the address information containing a corresponding set of a first location identifier, a second location identifier and a third location identifier, the first location identifier being a location identifier specific to the mobile computer which is uniquely defined within the own organization networks, the second location identifier being a location identifier reserved for the mobile computer which is uniquely defined over all the networks, and the third location identifier being a location identifier indicating a current visited location of the mobile computer in the communication network system which is uniquely defined over all the

networks; and processing means for obtaining the third location identifier corresponding to the first location identifier or the second location identifier of a destination computer attached to communication data transmitted from a source computer according to the address information, and transferring the communication data by attaching the obtained third location identifier to the destination computer.

Brief Summary Text (18):
According to another aspect of the present invention there is provided a data packet processing device for processing communication data in a communication network system formed by a plurality of computers for communicating data with each other through a plurality of interconnected networks, said plurality of computers including at least one mobile computer for communicating data while changing a location in the communication network system, the data packet processing device being provided in a home network of the mobile computer and comprising: management means for managing an address information for the mobile computer within own organization networks of the mobile computer, the address information containing a corresponding set of a first location identifier, a second location identifier and a third location identifier, the first location identifier being a location identifier specific to the mobile computer which is uniquely defined within the own organization networks, the second location identifier being a location identifier reserved for the mobile computer which is uniquely defined over all the networks, and the third location identifier being a location identifier indicating a current visited location of the mobile computer in the communication network system which is uniquely defined over all the networks; and processing means for receiving communication data transmitted from a relay device provided in the home network of the mobile computer which is encapsulated using the third location identifier corresponding to the first location identifier, then decapsulating the communication data using the third location identifier, then encapsulating the communication data using the second location identifier corresponding to the third location identifier, then encapsulating the communication data using the third location identifier, and then transmitting the communication data to an external other organization network, when the mobile computer is located within the external other organization network and the communication data has a destination specified by the first location identifier.

Drawing Description Text (3):
FIG. 2 is an illustration of a basic data content of a location identifier memory unit according to the present invention.

Drawing Description Text (4):
FIG. 3 is a schematic block diagram of an exemplary communication network system for explaining the mobile computing protocol IETF/Mobile-IP (MIP) utilized in the first specific embodiment of the present invention.

Drawing Description Text (5):
FIG. 4 is an illustration of an exemplary data content of a location identifier memory unit according to the first specific embodiment of the present invention.

Drawing Description Text (14):
FIG. 13 is an illustration of an exemplary data content of a location identifier memory unit according to the second specific embodiment of the present invention.

Detailed Description Text (6):
FIG. 2 shows a basic data content of a location identifier memory unit for storing three types of location identifiers (addresses) used in the communication control method of the present invention. More specifically, this location identifier memory unit of FIG. 2 is given in a form of a table concatenating three types of addresses, including H-addr (home address), M-addr (mobile address) and C-addr (care-of address). The H-addr is an address specific to the mobile computer 21

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L4: Entry 2 of 12 File: USPT Feb 4, 2003

DOCUMENT-IDENTIFIER: US 6515974 B1
TITLE: Mobile computer communication scheme supporting moving among networks of different address systems

Abstract Text (1):
A communication scheme for supporting data transfer to a visited site of a mobile terminal which moves across a private network operated by a private address system and an Internet operated by a global address system is disclosed. When the mobile terminal has moved from the first network to the second network, packets destined to an original home address of the mobile terminal on the first subnet are transferred from the first router device in the first subnet by setting an address of the first interface of a packet relay device as a care-of address of the mobile terminal. Then, the packets received by the packet relay device from the first router device at the first interface are transferred to the second router device in the second subnet through the second interface of the packet relay device, and the packets received by the second router device from the packet relay device are transferred to a current location address of the mobile terminal.

Application Filing Date (1):
19990616

Brief Summary Text (8):
On the other hand, a technique for accommodating mobile terminals into the Internet-like network has been studied and developed. As one such mobile access technique, a scheme utilizing Mobile IP is known.

Brief Summary Text (9):
Mobile IP deals with the case where a user carrying a mobile terminal communicates while moving over the IP network across a plurality of subnets. In the case of communicating while moving over the IP network where the network address of the mobile terminal changes as the location of the terminal changes, there is a need to provide a scheme for managing a location of the terminal and transferring communication contents properly, and Mobile IP is a scheme that is proposed in order to fulfill that need. Mobile IP is a technique which makes the mobile terminal to appear to the other terminals as if it is connected at a location where it is normally expected to be located (a home address of a home network), regardless of a location at which the mobile terminal is connected on the network. Mobile IP has been promoted to RFC level by IETF in October, 1996.

Brief Summary Text (10):
In the following, the basic operation of Mobile IP will be described with reference to FIG. 1, which shows an exemplary network configuration in which a first network 100-1 and a second network 100-2 are connected through Internet 100-3. Here, each of these networks is assumed to be operated using global addresses.

Brief Summary Text (11):
In Mobile IP, a network (home network) 100-1 to which a mobile terminal (mobile host: MH) 103 is normally connected has a router called home agent (HA) 105 located therein. The mobile terminal 103 is assigned with a home address at the home

network, which is managed by the home agent 105. Here, for the sake of explanation, it is assumed that the home address of the mobile terminal 103 is "10.2" and the address of its home agent 105 is "10.1".

Brief Summary Text (13):
In order to notify the current location of the own node, the mobile terminal 103 notifies the IP address "20.1" of the current location from the visited site to the home agent 105. Upon receiving this notification, the home agent 105 manages a correspondence between the home address "10.2" and the current location address "20.1" of the mobile terminal 103.

Brief Summary Text (14):
Now, Mobile IP assumes that there exists a correspondent host who does not know that the mobile terminal 103 has moved. This correspondent host (CH) 109 that tries to communicate with the mobile terminal 103 does not know that the mobile terminal 103 has moved so that it transmits packets destined to the home address "10.2". However, the mobile terminal 103 is currently absent from the home network. Hence, the home agent 105 which manages this mobile terminal 103 intercepts (receives as a proxy) a packet destined to the home address "10.2", and transfers it by encapsulating it into an IP packet destined to the current location address "20.1" that is registered in advance. The foreign agent 106 that is located at the address "20.1" takes out this packet from the encapsulated packet that is transferred thereto, and delivers it to the visiting mobile terminal 103 at the datalink layer. By such a mechanism, the mobile terminal 103 can receive a packet that would have been received by the own node at its original home network 100-1, even at its visited site.

Brief Summary Text (16):
As described above, in Mobile IP, each node (correspondent host) on the network can access the mobile terminal 103 regardless of a location on the network at which the mobile terminal 103 is connected, by using the home address of the home network 103.

Brief Summary Text (17):
Now, in the Mobile IP scheme, a protocol is designed by assuming only a case where the mobile terminal moves within a single address space. That is, it has been assumed that the current location registration message (which is also referred to as the mobility registration message) from the visited site can reach the home agent of the home network without failure.

Brief Summary Text (19):
Thus, in such a case, Mobile IP can be utilized only within a range where the mobile terminal moves within a single address space. In other words, there has been a problem that Mobile IP cannot support those services in which the mobile terminal is allowed to move across networks operated by mutually different address systems.

Brief Summary Text (20):
FIG. 2 shows an exemplary case where Mobile IP cannot be utilized, which is a network model in which a communication service provider offers a service using mobile terminals that are capable of making Internet accesses. FIG. 2 shows an exemplary network configuration in which a private network 101 operated by a private address system and a global Internet 102-2 operated by a global address system are connected through Internet 102-1 operated by a global address system.

Brief Summary Text (22):
However, when the mobile terminal 103 which has its home network in a private region moves into a global region, Mobile IP cannot be used. On the contrary, when the mobile terminal which has its home network in a global region moves into a private region, Mobile IP also cannot be used.

Brief Summary Text (23):
In such a network model, it is not sufficient to realize a simple packet exchange between the private network and the global Internet, and it is also necessary to maintain currently carried out communications by utilizing the properties of Mobile IP even in a case where the mobile terminal that had been connected to the private network shortly before has now moved to the global Internet or vise versa.

Brief Summary Text (25):
As described above, in general, in order to support the mobile terminal which moves across the private network operated by the communication service provider and the global Internet by utilizing the Mobile IP scheme, it is necessary to provide a scheme for controlling a location to be regarded as the current home network according to the current location and the immediately previous location of the mobile terminal and a way of commanding transfer of packets to the current location with respect to the immediately previous home network, and for realizing the routing control up to the final destination by receiving the transmitted or transferred packet at the border between the private network and the global network and converting it into appropriate format.

Brief Summary Text (26):
Thus, in the case of supporting a service in which the mobile terminal can move across networks operated by mutually different address systems, the conventionally known mobile access technique for Internet-like network such as the usual mobile management by Mobile IP in a single address space is insufficient, and there is a need for a mechanism which can properly account for two types of address spaces such as the private network operated by the private address system managed by the communication service provider and the general global Internet, and realize not only the packet exchange across their border but also the proper routing control of packets up to the current location even when the mobile terminal moves across their border.

Brief Summary Text (29):
According to one aspect of the present invention there is provided a communication system for supporting data packet transfer with respect to mobile terminals capable of carrying out communications while moving among networks, in a first network and a second network which are operated by mutually different address systems and which are capable of accommodating the mobile terminals, the communication system comprising: a packet relay device having a first interface connected with the first network and a second interface connected with the second network; a first router device provided at a first subnet in the first network, having a function for transferring packets destined to a home address of each mobile terminal belonging to the first subnet to a care-of address of each mobile terminal; and a second router device provided at a second subnet in the second network; wherein when a mobile terminal has moved from the first network to the second network, the first router device transfers packets destined to an original home address on the first subnet of the mobile terminal by setting an address of the first interface of the packet relay device as a care-of address of the mobile terminal, the packet relay device transfers the packets received from the first router device at the first interface to the second router device through the second interface, and the second router device transfers the packets received from the packet relay device to a current location address of the mobile terminal.

Brief Summary Text (30):
According to another aspect of the present invention there is provided a method of data packet transfer in a communication system for supporting data packet transfer with respect to mobile terminals capable of carrying out communications while moving among networks, in a first network and a second network which are operated by mutually different address systems and which are capable of accommodating the mobile terminals, the communication system including a packet relay device having a first interface connected with the first network and a second interface connected

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L4: Entry 9 of 12 File: USPT Nov 5, 1996

DOCUMENT-IDENTIFIER: US 5572221 A
** See image for Certificate of Correction **
TITLE: Method and apparatus for detecting and predicting motion of mobile terminals

Abstract Text (1):
Methods and apparatus for detecting and predicting movement patterns of mobile radio transceivers, such as mobile cellular telephones, enhance the performance of hierarchical radio networks, in which network structures, such as different cells, have different communication bandwidths. One method of predicting a next location of a mobile terminal based on stored previous locations of the mobile terminal includes the step of comparing a current sequence that includes the current location of the mobile terminal and a plurality of previous locations of the mobile terminal to each of a plurality of stored sequences that each include previous locations of the mobile terminal. The method also includes the steps of selecting one of the stored sequences based on at least one quantitative measure of a degree of matching between the current sequence and each stored sequence, and predicting the next location of the mobile terminal based on the selected one of the stored sequences. Methods and apparatus for determining regular patterns in movements of a mobile terminal are also described, as is a communication network having a plurality of servers, the servers being positioned in respective geographical areas and organized in a distributed file system; a mobile terminal having a device for communicating with the server nearest the mobile terminal, the communicating device accessing application files and data files stored in the servers; and a mobile distributed system platform having a device for controlling the distributed file system of the servers and a device for predicting a next location of a mobile terminal, the controlling device distributing location sensitive information among the servers based on a next location predicted by the predicting device.

Application Filing Date (1):
19941026

Brief Summary Text (10):
Current networks are not efficient in wireless data accessing in that they do not support data and service mobility. While users and terminals are mobile, their data is still configured statically in the system. Traditionally, personal/terminal mobility management included passive functions for keeping track of the locations of the users/terminals and for maintaining connections to the terminals belonging to the system.

Brief Summary Text (24):
For example, an apparatus for predicting a next location of a mobile terminal based on previous locations of the mobile terminal includes a memory for storing sequences of previous locations of the mobile terminal, and a device, in communication with the memory, for comparing a current sequence that includes the current location of the mobile terminal and a plurality of previous locations of the mobile terminal to each of a plurality of stored sequences. The apparatus further includes a device for selecting one of the stored sequences based on at least one quantitative measure of a degree of matching between the current sequence and each stored sequence, and a device for generating a prediction of the next

location of the mobile terminal based on the selected one of the stored sequences.

Brief Summary Text (26):
In yet another aspect of Applicants' invention, a communication network comprises a plurality of servers, the servers being positioned in respective geographical areas and organized in a distributed file system; a mobile terminal having a device for communicating with the server nearest the mobile terminal, wherein the communicating device accesses application files and data files stored in the servers; and a mobile distributed system platform having a device for controlling the distributed file system of the servers and a device for predicting a next location of a mobile terminal, wherein the controlling device distributes location sensitive information among the servers based on a next location predicted by the predicting device.

Drawing Description Text (10):
FIG. 8 is a flowchart of a movement circle detection method in accordance with Applicants' invention;

Drawing Description Text (11):
FIG. 9 is a flowchart of a movement track detection method in accordance with Applicants' invention;

Detailed Description Text (3):
Using Applicants' invention, a mobile terminal or the communication network can predict the mobile's itinerary and take appropriate actions before the mobile reaches a new location. Such predictions can also be used for dynamic channel allocation, mobile terminal location, and call handoffs from channel to channel, either intra-cell or inter-cell, inter-layer or intra-layer. The predictions can be inputs to a locating algorithm, which generates a list of candidate communication channels for handover or assignment of a connection. As used in this application, the term "mobile terminal" will be understood to encompass mobile telephones, portable computers, mobiletexts, personal digital assistants, and like devices.

Detailed Description Text (42):
In generating itinerary patterns based on the MC model from states in the state queue, the IPD carries out a movement circle detection (MCD) method comprising the following steps, which are also illustrated in flowchart shown in FIG. 8. The MCD and methods in accordance with Applicants' invention are described in terms of C-language pseudocode, by which the methods may be implemented easily in hardware and software in any of the mobile stations, base stations, and mobile switching center of a cellular radiotelephone communication system.

Detailed Description Text (45):
Movement Track Detection (MTD) Method

Detailed Description Text (46):
In generating itinerary patterns based on the MT model, the IPD carries out a movement track detection (MTD) method comprising the following steps, which are also illustrated in flowchart shown in FIG. 9.

Detailed Description Text (72):
To efficiently support mobility, each user and each terminal may advantageously be represented in the network by respective agents, which contain all service logic and service data related to the user or terminal and control all communication sessions of the user or terminal. The users/terminals are connected to access nodes in the network, and the agents provide their services in serving nodes. In networks such as the GSM network in Europe, the base station controllers act as the access nodes and the MSC, with its integrated visitor location register, acts as both a serving node and a visited location. Various aspects of such intelligent networks and agents are described in L. Soderberg, "Evolving an Intelligent Architecture for

Personal Telecommunication", Ericsson Review vol. 70, no. 4, pp. 156-171 (1993), which is incorporated here by reference.

Detailed Description Text (74):
A Mobile Distributed System Platform (MDSP) and the MFA are designed to cope with the varying bandwidth and connectivity of different communication links at different locations and to support service and resource mobility. The MDSP typically includes Location-Sensitive Information Management (LSIM) functions and Predictive Mobility Management (PMM) functions in order to support different applications, such as mobile file systems, mobile intelligent networking, etc. In brief, the LSIM functions involve information about the services or resources (including hardware and software resources, network connectability, types of communication protocol available, etc.) provided by the systems or networks in a defined geographical area. The PMM functions involve predictions of the mobile terminal's location and Virtual-Distributed Floating Agent Assignment (FAA) functions, which assign the agent to different locations according to the location predictions and provide service pre-connection and service/resource mobility.

Detailed Description Paragraph Table (4):

BEGIN 1) IF an incoming S.sub.k,t is a new state, DO steps 2), 3), 4), ELSE DO steps 5), 6), 7), 8), ENDIF; 2) FOR each new incoming S.sub.k,t, keep a queue of k states (where 1 .ltoreq. k .ltoreq. N) in a FIFO order and mark S.sub.k,t as "Boundary State" based on the criteria; 3) IF the length of PD.sub.out is greater than unity, and S.sub.k,t is .mu.-matched with the first state of PD.sub.out, PD.sub.out = PD.sub.out - S.sub.k,t ; GOTO step 9); ENDIF; 4) execute motion prediction method (MPM); 5) IF S.sub.k,t = = S.sub.k,t-.tau. (for .tau. .gtoreq. .tau..sub.s), mark S.sub.k,t as "Stationary State" based on the criterion; ENDIF; 6) execute movement track detection (MTD) method; 7) execute movement circle detection (MCD) method; 8) Keep a number j of (MCs + MTs) in LRU-replacement order in an IPB, (where 0 .ltoreq. j .ltoreq. M); 9) Repeat from step 1); END

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